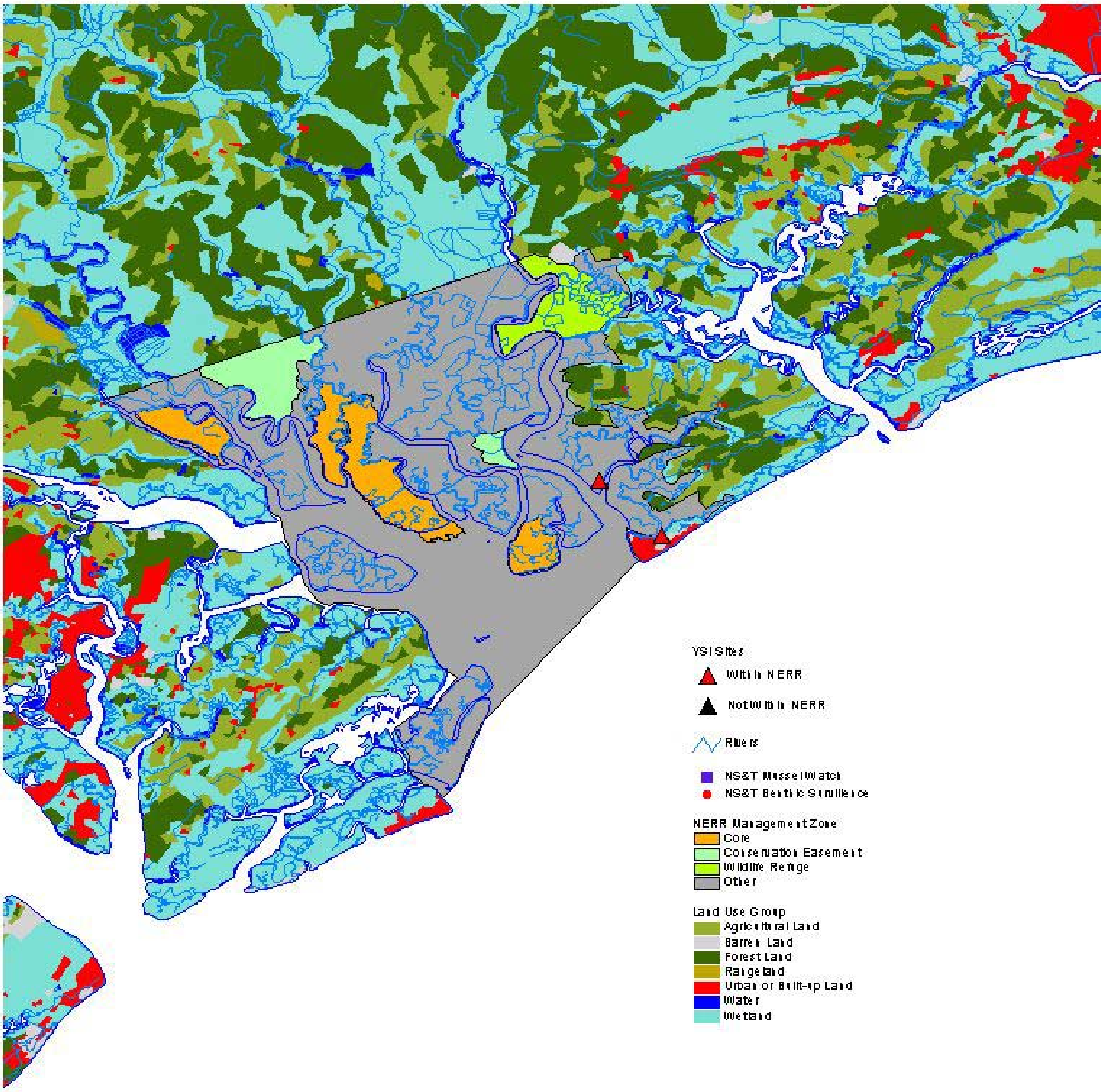
ACE Basin


YSI Sites
Within NERR
Not Within NERR
Rivers
NS&T Mussel Watch
NS&T Benthic Surveillence
NERR Management Zone
Core
Conservation Easement
Wildlife Refuge
Other
Land Use Group
Agricultural Land
Barren Land
Forest Land
Rangeland
Urban or Built-up Land
Water
Wetland

ACE Basin, Big Bay (ACEBB)

Characterization (Latitude = 32°09'37"N; Longitude = 80°19'26"W)
The Big Bay monitoring station is located in a small creek (2.5-3.7 m wide; 3 m deep at MHW) approximately 68 m from the mouth of Scott Creek, which is approximately 0.9-1.5 m deep at MLW and about 45 m wide. Scott Creek flows into Big Bay Creek about 18 m downstream from the mouth of the monitoring creek. Big Bay Creek is a tributary of the South Edisto River, which empties into St. Helena Sound. Creek bottom habitats are predominantly sand with lots of shell, but no submerged aquatic vegetation due to high turbidity. *Spartina alterniflora* and *Juncus roemerianus* are the dominant salt marsh vegetation. The dominant upland vegetation includes cabbage palmetto, live oak, and red cedar. The uplands contain homes (many with little or no setback or vegetation buffers), a 75-slip marina, several commercial fishing docks with 8-10 commercial shrimp vessels, and three restaurants. In addition, Big Bay Creek has 3 boat ramps and approximately 40 docks constructed of creosote, concrete, Wolmanized pilings, and CCA treated bulkheads. Recreational boat use in the creek near the monitoring site is heavy. Inter-tidal oyster beds are found along the undeveloped bank of Big Bay Creek; however, the creek is closed to shellfish harvesting because of fecal coliform contamination.

Descriptive Statistics
Forty-three deployments were made at this site between January 1996 and December 1998, with equal coverage during all seasons (Figure 119). Mean deployment duration was 19.5 days. Only two deployments (Sep 1996, 1998) were less than five days.

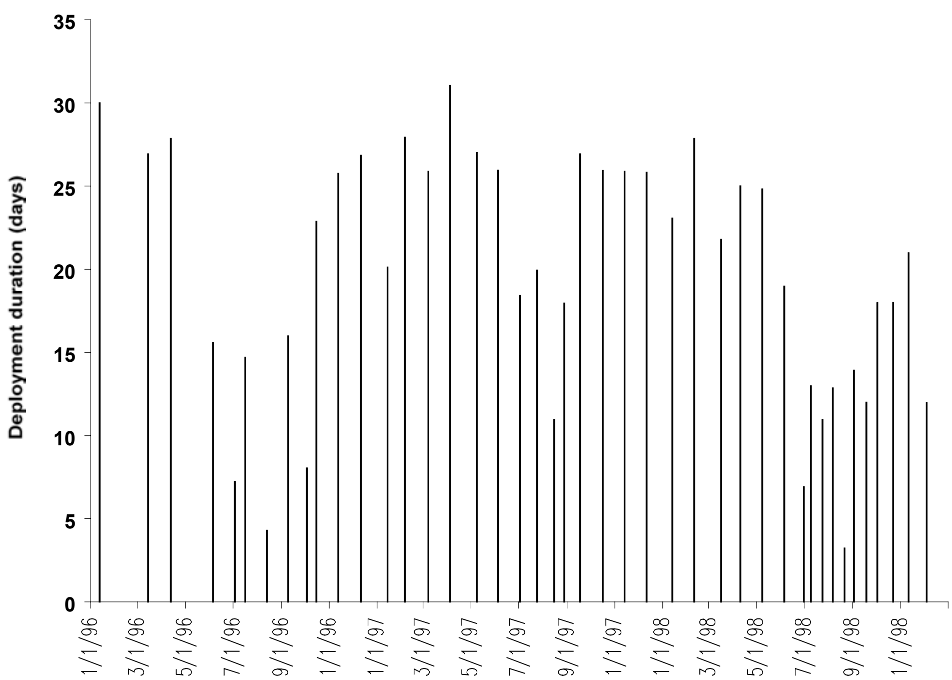


Figure 119. ACE Basin, Big Bay Creek deployments (1996-1998).

Fifty-six percent of annual depth data were included in analyses (37% in 1996, 66% in 1997, and 64% in 1998). Sensors were deployed at a mean depth of 1.25 m below the water surface. Strong fluctuations in water depth (≥ 1m) were associated with daily and spring-neap tidal cycles. Harmonic regression analysis attributed 93% of water depth variation to 12.42 hour cycles, 4% of depth variance to 24 hour cycles, and 3% of depth variance to interaction between 12.42 hour and 24 hour cycles.

Seventy-five percent of annual water temperature data were included in analyses (61% in 1996, 89% in 1997, and 75% in 1998). Water temperature followed a seasonal cycle, with typical water temperatures 10-12°C in the winter and 27-29°C in the summer (Figure 120). Minimum and maximum water temperatures recorded between 1996-1998 were 2.6°C (Jan 1996) and 36°C (Jun 1997), respectively. Scatter plots suggest strong (2°C) fluctuations in daily water temperature and even stronger (≥ 5°C) fluctuations in bi-weekly water temperature during all seasons. Harmonic regression analysis attributed 60% of variance to interaction between 12.42 hour and 24 hour cycles, 10% of temperature variance to 12.42 hour cycles, and 30% of temperature variance to 24 hour cycles.

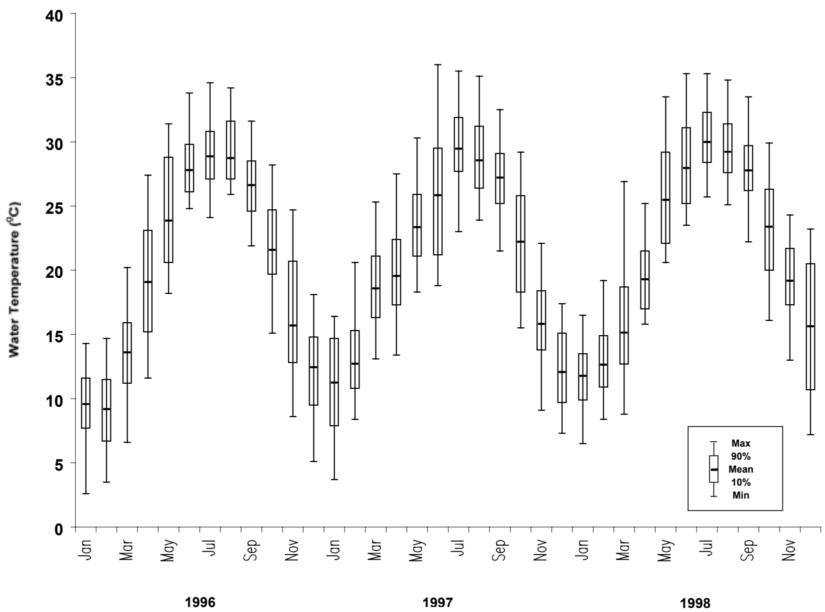


Figure 120. Water temperature statistics for Big Bay Creek, 1996-1998.

Seventy-five percent of annual salinity data were included in analyses (61% in 1996, 89% in 1997, and 75% in 1998). Salinity followed a less pronounced seasonal cycle than water temperature (Figure 121). Mean salinity was lowest in winter and spring and greatest in summer. Mean salinity in winter/spring was typically 25-27 ppt (1996-1997) compared to a mean salinity of ≥ 30 ppt in summer. Winter/spring salinity in 1998 (an El Niño year) was noticeably lower than winter/spring 1996-1997, with typical salinity around 20 ppt. Minimum and maximum salinity observed between 1996-1998 was 4.3 ppt and 41.7 ppt, respectively. Scatter plots suggest strong variation (≥ 5ppt) in daily salinity and stronger variation (≥ 20 ppt) during several episodic events in 1996-1998. Harmonic regression analysis attributed 80% of salinity variance to 12.42 hour cycles, 8% of salinity variance to 24 hour cycles, and 12% of salinity variance to interaction between 12.42 hour and 24 hour cycles.

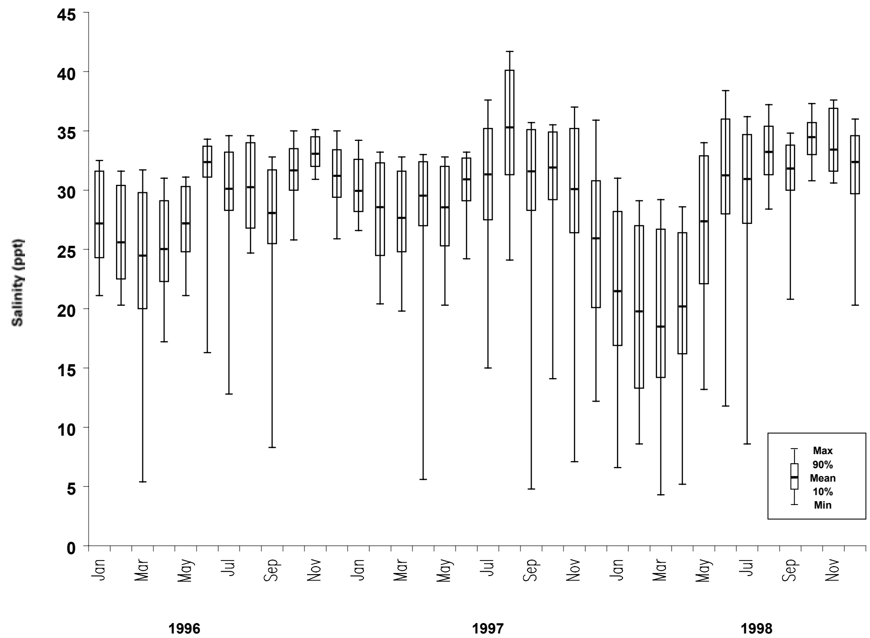


Figure 121. Salinity statistics for Big Bay Creek, 1996-1998.

Fifty-six percent of annual dissolved oxygen (% saturation) data were included in analyses (37% in 1996, 66% in 1997, and 64% in 1998). Dissolved oxygen readings were generally lowest in the summer months. Typical DO in the summer was 65-70% saturation. In Oct 1998, DO was registered at almost 500% saturation and on several occasions DO was registered at approximately 0% saturation. Hypoxia and supersaturation were infrequently observed in all seasons (Figure 122). Hypoxia rarely persisted more than 5% of the first 48 hours post-deployment and only occurred between Jul-Sep (with the exception of Jan 1998). Supersaturation usually lasted about 10% of the first 48 hours post-deployment and occurred in all seasons except spring. Scatter plots indicate that DO often fluctuated drastically (≥ 20% saturation) on daily cycles and even more drastically (≥ 40% saturation) on bi-weekly cycles. Harmonic regression analysis attributed 40% of DO variance to 12.42 hour cycles, 21% of DO variance to 24 hour cycles, and 39% of DO variance to interaction between 12.42 hour and 24 hour cycles.

Photosynthesis/Respiration

Over three quarters (79%) of the data used to calculate the metabolic rates fit the basic assumption of the method (heterogeneity of water masses moving past the sensor) and were used to estimate net production, gross production, total respiration and net ecosystem metabolism (Table 26). Instrument drift during the duration of the deployments was not a significant problem at this site. Respiration rates exceeded production rates at Big Bay and the net ecosystem metabolism and P/R ratio indicated that this is a very heterotrophic site (Figure 123). Temperature was significantly ($p<0.05$) correlated with gross production, total respiration and net ecosystem metabolism. Gross production and respiration increased as temperature increased, while net ecosystem metabolism became more heterotrophic as temperatures increased. Salinity was significantly ($p<0.05$) correlated with gross production and net ecosystem metabolism, but not total respiration. Production was higher at higher salinity, while net ecosystem metabolism was more autotrophic at higher salinity.

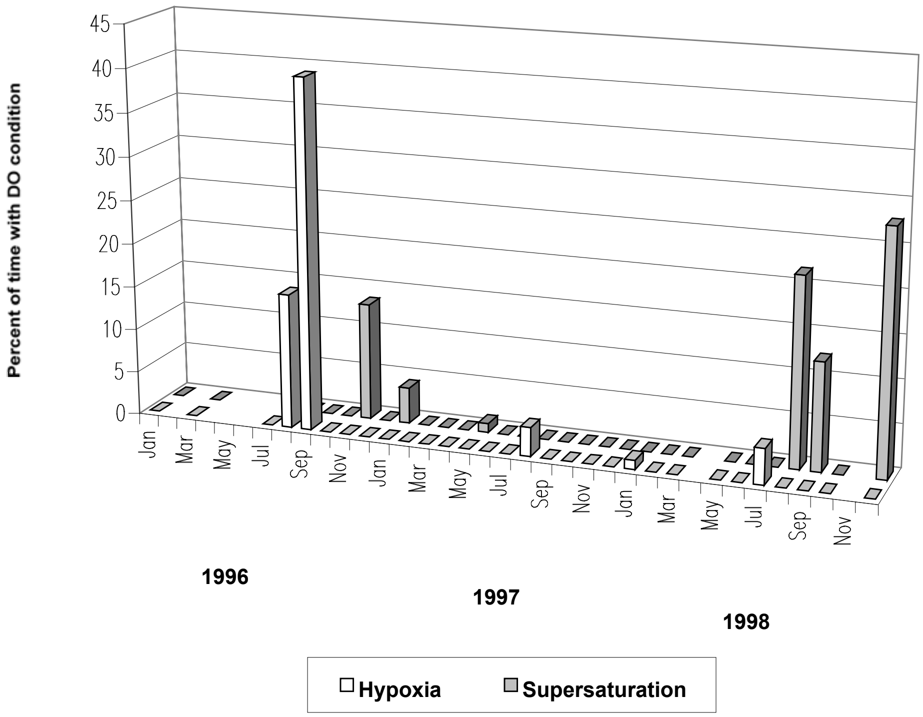


Figure 122. Dissolved oxygen extremes, Big Bay Creek (1996-1998).

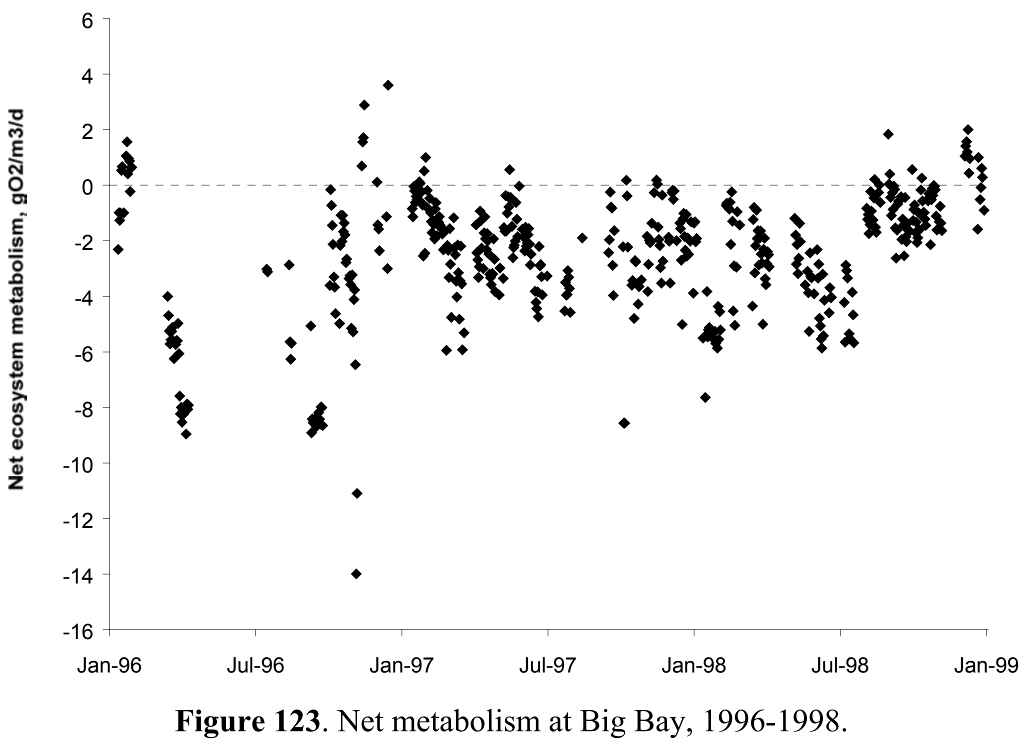


Figure 123. Net metabolism at Big Bay, 1996-1998.

Table 26. Summary of metabolism data and statistics for Big Bay, 1996-1998.

Big Bay	mean	s.e.
Water depth (m)	3.0	
Net production gO_2/m3/d	0.33	0.08
Gross production gO_2/m3/d	2.86	0.10
Total respiration gO_2/m3/d	4.90	0.13
Net ecosystem metabolism g O_2/m3/d	-2.04	0.09
Net ecosystem metabolism g C/m2/y	-541	
P/R	0.58	
Statistical results		
Drift – paired t-test		
Gross production	ns	
Total respiration	ns	
Net ecosystem metabolism	ns	
Percent useable observations	79%	
Paired t-test on gross production and total respiration	p<0.001	
Correlation coefficient	Temperature	Salinity
Gross production	0.33	0.13
Total respiration	0.35	ns
Net ecosystem metabolism	-0.16	0.23

ACE Basin, St. Pierre Creek (ACESP)

Characterization (Latitude = 32°01'43"N; Longitude = 80°2'34"W)
The St. Pierre monitoring station is located in a creek that is approximately 18 m wide and about 4.5 m deep at MHW (2 m deep at MLW). Creek bottom habitats are muddy and devoid of vegetation. The monitoring site is approximately 137 m from the mouth of the creek that empties into St. Pierre Creek, a tributary of the South Edisto River that flows into St. Helena Sound. There are no submerged aquatic plant communities in this creek. *Spartina alterniflora* is the dominant vegetation in the salt marshes surrounding the area. Extensive mud flats and oyster reefs fringe the banks. The dominant upland vegetation is wax myrtle, live oak, and palmettos. Development in the immediate area is sparse. The creek near the monitoring site is subject to light boat traffic.

Descriptive Statistics
Forty-three deployments were made at this site between January 1996 and December 1998, with equal coverage during all seasons (Figure 124). Mean deployment duration was 18.6 days. Only four deployments (Nov 1996, Jul-Aug 1997, and Aug 1998) were less than five days.

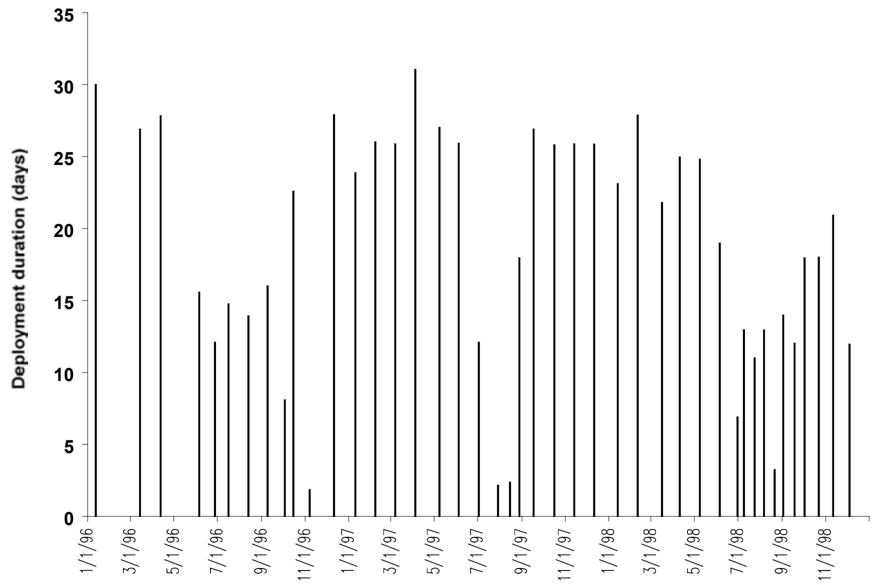


Figure 124. ACE Basin, St. Pierre Creek deployments (1996-1998).

Sixty-nine percent of annual depth data were included in analyses (59% in 1996, 82% in 1997, and 65% in 1998). Instruments were typically deployed at a depth of 1.74 m below the water surface. Strong (≥ 1 m) fluctuations in water depth were evident for daily and bi-weekly cycles from scatter plots. Maximum fluctuation in water depth appeared to occur at regular, bi-weekly intervals, presumably associated with spring-neap tidal cycles. Harmonic regression analysis attributed 94% of these fluctuations to 12.42 hour cycles, 4% of depth variance to 24 hour cycles, and 2% of depth variance to interaction between 12.42 hour and 24 hour cycles.

Seventy percent of annual water temperature data were included in analyses (59% in 1996, 79% in 1997, and 72% in 1998). Water temperature followed a seasonal cycle, with mean water temperatures 10-12°C in winter and 27-29°C in summer (Figure 125). Winter 1996 was slightly cooler than winter 1997 and 1998, whereas summer 1997 was slightly cooler than summer 1996 and 1998. Minimum and maximum water temperatures recorded between 1996-1998 were 4.3°C (Jan 1997) and 45.9°C (Aug 1997), respectively. Scatter plots suggest strong fluctuations (2°C) in daily water temperature and even stronger fluctuations (≥5°C) in bi-weekly water temperature during all seasons. Harmonic regression analysis attributed 59% of temperature variance to interaction between 12.42 hour and 24 hour cycles, 32% of variance to 24 hour cycles, and 9% of variance to 12.42 hour cycles.

Fifty-nine percent of annual salinity data were included in analyses (59% in 1996, 54% in 1997, and 64% in 1998). Salinity followed a less pronounced seasonal cycle than water temperature, but a seasonal cycle was still evident (Figure 126). In general, mean salinity was lowest in the cool, wet winter and spring months and greatest during the warm, dry summer months. Mean salinity in the winter/spring was typically 22-24 ppt (1996-1997) compared with typical salinity of 28-30 ppt in the summer. Winter/spring salinity in 1998 (an El Niño year) was lower than winter/spring 1996-1997, with typical salinity around 16-18 ppt. Minimum and maximum salinity observed between 1996-1998 was 6.6 and 46.0 ppt, respectively, and both occurred in April 1998. Scatter plots suggest strong variation in salinity (≥ 5 ppt) each day with even stronger fluctuations (≥ 20 ppt) observed during several episodic events in 1996-1998. Harmonic regression analysis attributed 86% of salinity variance to 12.42 hour cycles and 7% of salinity variance to both 24 hour cycles and interaction between 12.42 hour and 24 hour cycles.

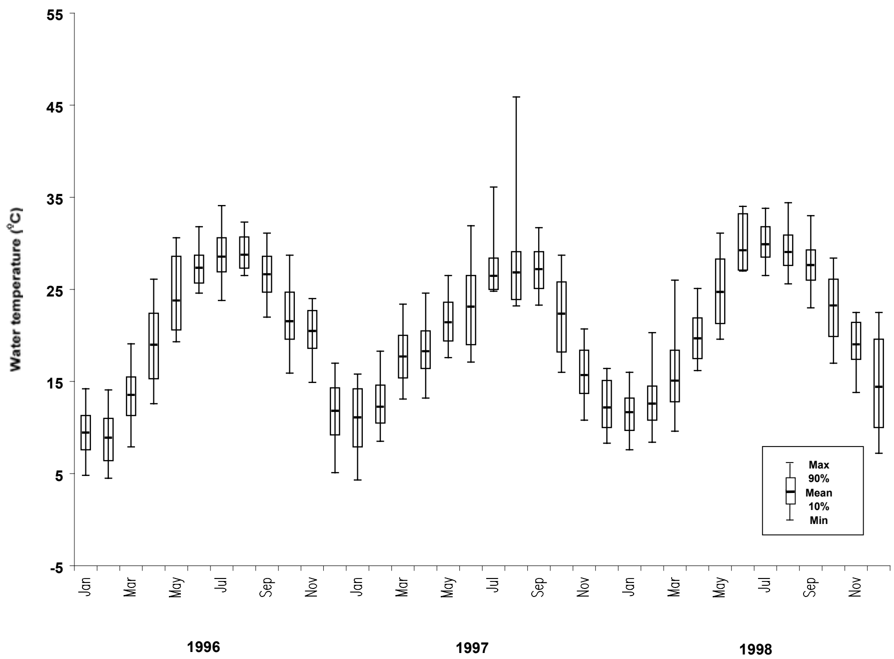


Figure 125. Water temperature statistics for St. Pierre Creek, 1996-1998.

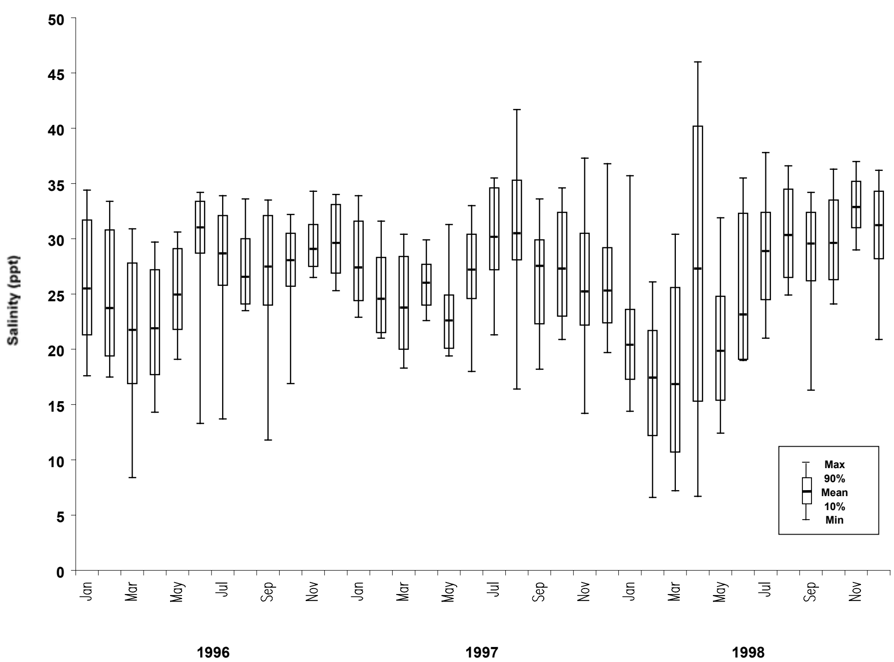


Figure 126. Salinity statistics for St. Pierre Creek, 1996-1998.

Forty-four percent of annual dissolved oxygen (% saturation) data were included in analyses (41% in 1996, 1997 and 52% in 1998). Mean DO was typically 65-90% saturation. Mean percent saturation was usually greatest in winter (88-100%); however, the greatest mean percent saturation (106%) was recorded in June 1998. Mean percent saturation was lowest in July-August, particularly in 1996 (17-36%). On one occasion, DO exceeded 280% (Dec 1996) and on several occasions DO approached 0% saturation. Hypoxia and supersaturation events were rarely observed in all seasons (Figure 127). With the exception of July-August 1996, when hypoxia persisted for almost 50% of the first 48 hours post-deployment, hypoxia usually lasted ≤ 5% of the first 48 hours post-deployment when present. When present (Jan 1996; Jul, Dec 1998), supersaturation typically persisted < 0.25% of the first 48 hours post-deployment. Scatter plots indicated that dissolved oxygen varied drastically (≥ 20%) on daily cycles and even more drastically (≥ 40%) on bi-weekly cycles. Harmonic regression analysis attributed 38% of DO variance to 12.42 hour cycles, 18% of DO variance to 24 hour cycles, and 44% of DO variance to interaction between 12.42 hour and 24 hour cycles.

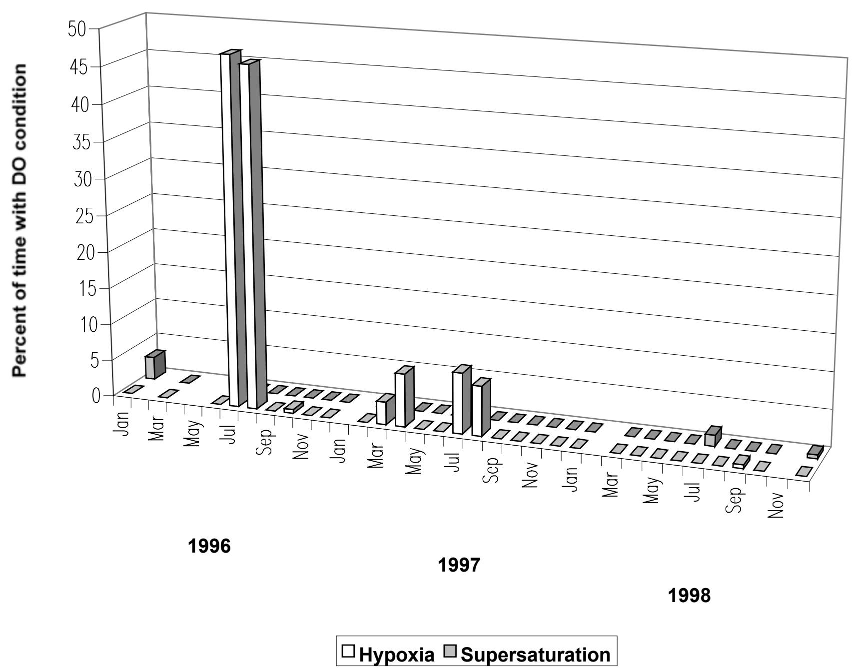


Figure 127. Dissolved oxygen extremes, St. Pierre Creek (1996-1998).

Photosynthesis/Respiration

Over 90% (92%) of the data used to calculate the metabolic rates fit the basic assumption of the method (heterogeneity of water masses moving past the sensor) and was used to estimate net production, gross production, total respiration and net ecosystem metabolism (Table 27). Instrument drift during the duration of the deployments was not a significant problem at this site. Respiration rates exceeded production rates at St. Pierre; thus, the net ecosystem metabolism and P/R ratio indicated that this is a heterotrophic site (Figure 128). Temperature was significantly ($p<0.05$) correlated with gross production, total respiration and net ecosystem metabolism. Gross production and respiration increased as temperature increased, while net ecosystem metabolism became more heterotrophic as temperatures increased. Thus, the metabolic rates generally followed a seasonal pattern with the highest rates during summer months and the lowest rates during winter. Salinity was not significantly ($p<0.05$) correlated with any of the metabolic measurements.

Table 27. Summary of metabolism data and statistics for St. Pierre Creek, 1996-1998.

St. Pierre	mean	s.e.
Water depth (m)	4.5	
Net production $gO_2/m3/d$	0.65	0.06
Gross production $gO_2/m3/d$	3.52	0.14
Total respiration $gO_2/m3/d$	4.16	0.13
Net ecosystem metabolism g $O_2/m3/d$	-0.64	0.09
Net ecosystem metabolism g C/m2/y	153	
P/R	0.85	
Statistical results		
Drift – paired t-test		
Gross production	ns	
Total respiration	ns	
Net ecosystem metabolism	ns	
Percent useable observations	92%	
Paired t-test on gross production and total respiration	p<0.001	
Correlation coefficient	Temperature	Salinity
Gross production	0.34	ns
Total respiration	0.48	ns
Net ecosystem metabolism	-0.18	ns

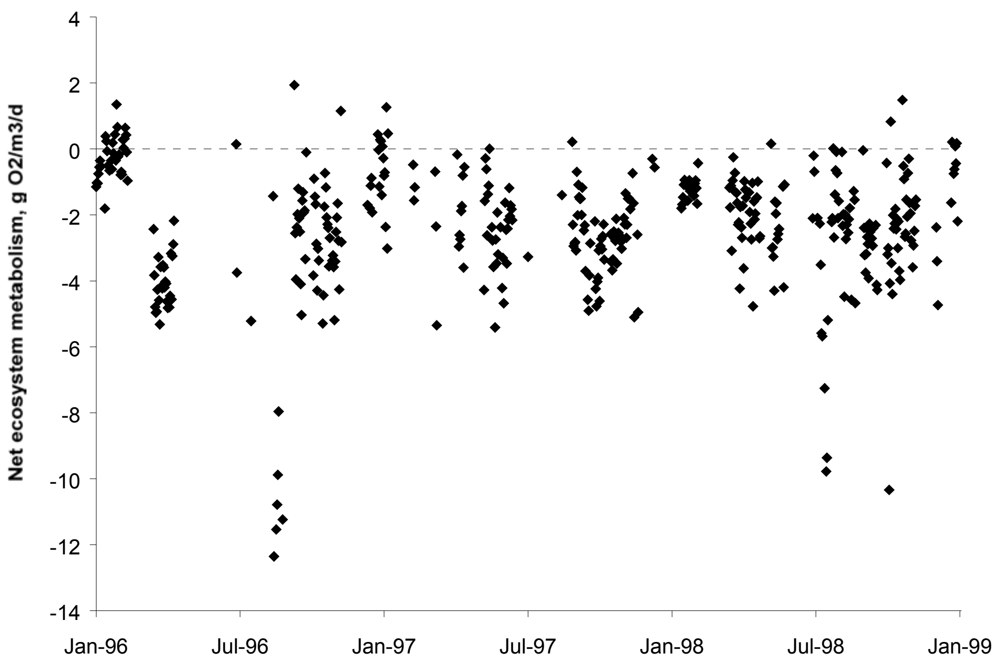


Figure 128. Net metabolism at St. Pierre Creek, 1996-1998.